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MECHANICS FOR STUDENTS.

Mechanics, a School Course. By W. D. Eggar, Pp. viii+288. (London: Edward Arnold, 1905.) Price 3*s.* 6*d.*

Elements of Mechanics. By Prof. Mansfield Merriman. Pp. 172. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1905.) Price 1 dollar net.

An Intermediate Course of Mechanics. By A. W. Porter. Pp. viii+422. (London: John Murray.) Price 5*s.*

MR. EGGAR is doing good work in the movement which aims at the extension of quantitative measurements in the courses of mathematical studies for youths, and a school book of mechanics from the author of the well known experimental introduction to geometry is sure to be received with favour and interest by teacher and pupil alike. We may say at once that readers are not likely to be disappointed, for the experimental work on which the fundamental principles are based is simple, suggestive, and thorough, and the essence of the subject is not obscured by an undue amount of mathematical dressing.

The first five chapters are concerned with the verification and elucidation of Newton's laws of motion, and some very efficient apparatus is introduced and described in this admittedly difficult portion of the subject; we agree with the author that "velocities, accelerations, moments, work, and momentum can be made clear to a student if he has to measure them." Experiments of Galileo by means of which the laws of falling bodies were discovered are introduced with suitable modifications; a clever method of measuring time by the use of a vibrating spring carrying a paint brush (due to Mr. Fletcher) is employed, and altogether this section, treating kinetics experimentally, is most interesting and very satisfactory. The next five chapters relate to statics and the equilibrium of forces, and the remaining portion of the book deals with work, friction, simple machines, projectiles, circular and simple harmonic motions, stress and strain, and fluids.

There is little in the book to which exception can be taken. When the author seems to imply that the unit of force in the "engineer's" system is a variable quantity, he appears to misapprehend the system. The experiments on change of motion are confined to straight-line motion. The student would have been led to a more comprehensive view of the subject if there could have been introduced an experiment illustrating vector change in plane motion, accompanied by the plotting of a hodograph. Then, instead of resorting to an antiquated and non-instructive proof for the acceleration in uniform circular motion, the hodograph could have been used to illuminate the principle that force is the time rate of change of momentum.

The test is arranged so that statics can be taken before kinetics if this procedure is thought desirable, but the sequence adopted by Mr. Eggar seems to us the right one. In addition to the experimental work, numbers of good and suggestive exercises are provided at appropriate intervals. The author has succeeded in producing a most admirable text-book, and one which we should like to see largely used throughout the schools of the country.

The aim of Prof. Merriman in his volume is to introduce mechanics to young engineering students in a manner whereby the principles are established by constant appeals to experience, and are not lost sight of by the introduction of a mass of algebraical matter. The intention is good, but the experience should be that gained first-hand by the student himself from experimental work in a laboratory. The method employed by the author is to base the science on axioms which the reader has to take largely on trust. After the first four pages, six of these are suddenly introduced. Thus:—"*Axiom* 1. Where only one force acts on a body, it moves in a straight line in the direction of that force."

As a professor of civil engineering, the author naturally gives more attention to statics than to dynamics. In fact, the latter branch is very feebly presented, and the subject does not gain by the substitution of the axioms for Newton's laws. For example, the fundamental principle that impulse is equal to change of momentum is nowhere found. For the acquirement of a knowledge of the subject reliance is largely placed on the working of the four hundred problems, mostly numerical, which are spread over the book.

In Prof. Porter's elementary text-book of theoretical mechanics the subject is presented so as to appeal to physicists rather than to engineers. Students reading for the intermediate pass examination of London University will find the book very helpful. A few experiments in verification of the laws of mechanics are described, but the treatment is almost wholly deductive. The author begins by discussing the kinematics and kinetics of the rectilinear motion of a rigid body, and is very happy in his explanations of the fundamental conceptions of space, time, mass, momentum, &c., particular attention being paid to the units of measurement and to the change from one set of units to another. In defining the several systems, however, the author seems to be mistaken in his view that the unit of force adopted by engineers is a variable one depending upon latitude.

The consideration of the mechanics of a particle is preceded by a chapter on the addition of vectors, in which some elementary trigonometry is introduced. The author might here have improved his definitions of the trigonometrical ratios for angles of any magnitude by making use of the projections of a rotation vector. The action of couples and the dynamics of rigid bodies having plane motion are next considered, and very logically, but here a few additional experiments personally carried out would have materially added to the student's grip of this somewhat difficult part of the subject. There is a chapter dealing mathematically

with some simple mechanical contrivances such as the wedge, screw, lever, and pulley; another on simple harmonic motion, in which the pendulum is rather fully dealt with; and then follows a chapter devoted to the mechanics of fluids, and comprising an examination of the stability of floating bodies. The book concludes with a chapter on units and dimensions.

Sets of examples are given, the numerical answers being collected at the end of the volume. Specimens of recent intermediate science examination papers of University College in connection with the University of London are appended. Some will regret that the author does not assume a slight acquaintance with the Calculus such as must be possessed by most readers of the book. But taken altogether the subject is dealt with very thoroughly, and developed naturally and logically, and the book deserves a wide circulation.

MUSIC OF SINGING-BIRDS.

Field Book of Wild Birds and their Music. By F. Schuyler Mathews. Pp. xxxv+262. (New York and London: G. P. Putnam's Sons, 1904.) Price 2 dollars.

THIS is a very pretty little book, with many charming illustrations of American singing-birds, and numerous attempts to represent their songs in our musical notation. It would seem as if the songs of American birds lent themselves more readily than those of our European species to such notation, for this is by no means the first attempt of this kind which has recently been made on the other side of the water. The present reviewer is under the disadvantage of not having heard these birds in their native land, and is quite ready to believe that Mr. Mathews's musical notations may give an American some vague idea of what his birds sing; at the same time, as one whose knowledge of music is even older than his knowledge of birds, he must emphatically express a hope that British ornithologists will not imitate their American brethren in trying to render our familiar songs on this system. Our music is a highly artificial product, subject to strict limitations which have gradually been placed upon it as the art has developed in the course of many centuries; and to attempt to catch and (so to speak) to tame the songs of wild birds, bringing them forcibly under conditions which entirely deprive them of their natural freedom in regard to pitch, scale, time, and rhythm, is in almost all cases to do them cruel violence. A very few of our birds—the cuckoo, for example, and the song-thrush—have vocal utterances which can be expressed on our musical scale; but by far the greater number can only be represented in the amusing way in which Mr. Mathews has noted the song of the bobolink on pp. 50 and 51—by a cloudy jumble of notes and lines above the stave, which suggests a flute-player gone mad.

The sentence which he has prefixed to this curious bit of notation really explains his object and method, and forbids us to take him too scientifically. He says, "If one prefers not to *interpret* bird-music, but to take it from Nature exactly as it comes, this bit that follows may prove acceptable." What he has really been trying to do, it seems, is to *interpret* bird-music, by which he means that he has listened to it with a musical mind, and has gained from it certain musical impressions, which he again interprets to us in the language of our musical art, not only in the form of melody confined in the fetters of our musical scale, but in many cases enriched with ingenious accompanying harmonies. The reader will find a good illustration of this method in the treatment of the song of the American song-sparrow, pp. 110 foll. It is the method pursued by all who seriously attempt to transfer the notes of birds to music-paper, though it may be doubted whether they would all acknowledge this as frankly as Mr. Mathews. It follows that our knowledge of bird-music is not really increased by these efforts, charming and interesting as they often are to the musician; for what is put upon paper is not the song of the bird, but an interpretation of it by an artistic mind. Taken in this light, this little book may give much pleasure, and may add a good deal to our knowledge of some delightful American songsters.

W. W. F.

OUR BOOK SHELF.

Studien ueber Hautelektricität und Hautmagnetismus des Menschen. By Dr. Erik Harnack. Pp. 65. (Jena: Gustav Fischer, 1905.) Price 1.60 marks.

THE author takes a pocket-compass, about the size of a lady's watch, with metal case and watch-glass top, and having placed it on a level surface lightly rubs the glass with the tip of his finger. The needle is immediately deflected from the magnetic meridian, remaining so for a minute or more, and then returning to its original position. That magnetism has nothing to do with it is shown by the fact that the same phenomenon occurs when for the magnet there is substituted a needle of nickel, platinum, zinc, bismuth, or ivory, although the absence in such cases of a directive force makes it more difficult to observe. Static charges, apparently much stronger, are without effect. Some people can influence the needle much more than others, and the author's power is not always equally strong.

Quantitative experiments were undertaken by the author to measure the E.M.F. induced by rubbing a glass plate of the same size and shape in the same manner. Using a Braun electrometer graduated up to 1500 volts, the maximum value obtained by him was 1300 volts. It seems evident that a strong electric charge is developed on a part of the glass surface by the friction of the finger upon it, and that the needle being free to move, and, moreover, in metallic connection with the case, is attracted by the charged surface.

This is not disputed by the author, his contention being that the magnitude of the effect is out of all proportion to the force expended, and that, therefore, it is not due to physical but to physiological causes set in action by the slight friction of the finger-tips. In the present writer's opinion this contention is certainly not substantiated. The total energy of the charge of a condenser composed of a compass-needle and a square centimetre or so of glass with a P.D. of a thousand or, for that matter, of ten thousand volts is trifling, and since the work actually done consists in the mere turning of the needle through 90°, one is driven to ask whether if a cocoon fibre were attached to the end of the needle and to the